

CLAIMS

1. A method of pyrometallurgical treatment of metals, metal melts, and/or slags in a metallurgical installation or a melting vessel, in particular for blowing up or in oxygen-rich gases in electrical arc furnace with an injection device with accelerates oxygen-containing gases (6) to a supersonic speed, with an ejected, therefrom, high-velocity jet (6') being protected by a gaseous envelope completely enveloping same for using the same for pyrometallurgical treatment,

characterized in that

the gaseous envelope is formed of a hot gas (5) that is so fed to the central high-velocity jet (6') that relative speed and pulse exchange between the central high-velocity jet (6') and the hot gas enveloping jet (5') is minimized (quasi isokinetic feeding).

2. A method according to claim 1,

characterized in that

the oxygen-rich gas (6) is accelerated in a nozzle system (preferably in Laval form) to a speed from 300 to 800 m/sec, and the hot gas (5) is accelerated to approximately same speed with an annular slot nozzle (4).

3. A method according to claim 1 or 2,

characterized in that

an oxygen content of the oxygen-rich gas (6) amounts from 10 to 100% by volume, preferably, more than 95% by volume.

4. A method according to claim 1, 2, or 3,

characterized in that

particle-shaped solid materials and/or liquid material (8), if needed, is fed to the central oxygen jet (6), wherein feeding of these substances is effected with an additive injector (15) coaxially arranged in the oxygen injector (10) in the same direction and before an end of the acceleration process.

5. A method according to claim 4,

characterized in that

the particle-shaped solid material contains carbon (e.g., coal or coke dust), alkali and/or alkali earth metals (e.g., limestone, unhydrate lime, or dolomite, and the fluid material (8') contain carbon (e.g., natural gas, coke gas, converter gas, heating oil), respectively, in high concentration (more than 30% by weight).

6. A method to one or several of claims 1 through 5,

characterized in that

the hot gas (5) has a temperature from 300 to 1, 800°C upon entering the injection device.

7. A method according to claim 6,

characterized in that

the hot gas (5) becomes available due to an external reaction of fuel (8, 8') with an oxidant and/or as a result of recirculation of hot gases from the metallurgical installation.

8. A method according to claim 7,

characterized in that

for producing of the hot gas, a preheated oxidant with an oxygen content from 10 to 100% by volume, preferably, 21% by volume is used.

9. A method according to claim 6 or 8,

characterized in that

the preheating of the oxidant is integrated in a cooling system of the injection device (1) and/or forms an essential component thereof.

10. A method according to claim 8 or 9,

characterized in that

adjustment of hot gas temperature in front of the injection device (1) is effected by controlling power of a hot gas generator (20) and/or by adding water (19) to the hot gas before its acceleration.

11. A method according to one or several of claims 1 through 10,

characterized in that

the oxygen injector (10) operates alternatively with a technical oxygen and air, wherein a switch from oxygen supply to air supply and back is effected by using (31), and for air supply, an oxidant source or another source, e.g., a compressed air network (22) or a blower (21) is used.

12. A method according to one or several of claim 1 through 11,

characterized in that

the control of the operation of the hot gas generator (20), e.g., λ – control of combustion, the control of the hot gas temperature, the control of a cooling exit temperature, etc. is effected by an automation unit (R1).

13. A method according to one or several of claims 1 through 12,

characterized in that

the control of the operation of the oxygen injector (10), e.g., volume flow, admittance pressure, etc. is effected by an automation unit (R2).

14. A method according to one or several of claims 1 through 13,

characterized in that

the control of the operation of the additive injector (20), e.g., mass flow admittance pressure, etc., is effected by a further automation unit (R-3).

15. A method to one or several of claims 1 through 14,

characterized in that

more than one injector devices (1), preferably from two to four, are provided on the metallurgical installation.

16. A method according to one or several of claims 1 through 15,

characterized in that

coordination of operation of the automation devices (R1, R2, R3) is effected with an overriding central automation unit (R) that stands in data exchange with a process control system (PCS) of the metallurgical installation, or is self-sufficient, wherein the data exchange is effected with corresponding automation units of the injection devices (1).

17. An injection device (1) for pyrometallurgical treatment of metals, metal melts, and or slags in a metallurgical installation or a melting vessel, in particular for blowing up or in oxygen-rich gases and/or carbon-containing material in an electric arc furnace, wherein the injection device accelerates oxygen-containing gases, (6) to a supersonic speed, with an ejected therefrom, high-velocity jet (6') being protected by a gaseous envelope completely enveloping same for using the same for pyrometallurgical treatment, in particular for effecting the method of one or more of preceding claims

characterized in that

a modular construction of separate subassemblies consisting of an oxygen injector (10) with an inner wall (11) and a Laval nozzle (13) for accelerating an oxygen-rich gas (6), which is surrounded by a hot gas union (2) in an outlet region of which is arranged an annular slot nozzle (4) or similar constructed means with a comparable action for passing and acceleration of a hot gas (5).

18. An injection device (1) according to claim 17,

characterized in that

the oxygen injector (10) is axially displaceable and wherein an outlet plane (5) of the oxygen injector (10) in each position thereof is located between planes (E3) and (E4).

19. An injection device (1) according to claim 17 or 18,

characterized in that

outlet regions of the gases are extended by a common hot gas sleeve (3).

20. An injection device (1) according to claim 17, 18, or 19,

characterized in that

in the entrance region of the hot gas union (2), water spray means is arranged.

21. An injection device (1) according to one or several of claims 17 through 20,

characterized in that

within the central oxygen injector (10), an additive injector in form of an additional coaxial tube with an outlet opening (16), which is formed as a mouth or nozzle, is arranged.

22. An injection device (1) according to claim 21,

characterized in that

the outlet opening (16) of the additive injector (15) is formed of a wear-resistant material and is replaceable.

23. An injection device (1) according to claim 21 or 22,

characterized in that

the additive injector (15) is axially displaceable and is positioned with its outlet plane (B) between planes (E1) and (E2).

24. An injection device (1) according to one or several of claims 17 through 23,

characterized in that

separate subassemblies of the injector device (1) are mounted on a common support arranged in a wall of the metallurgical installation.